

AD-A283 434



Unclassified Paper

1

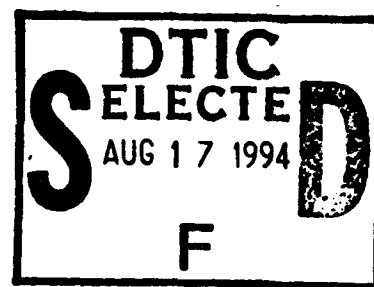
NAVAL WAR COLLEGE
Newport, R.I.

METEOROLOGICAL FACTORS AT THE OPERATIONAL LEVEL OF WAR

by

Jeffrey L. Barker

CDR USN



A paper submitted to the faculty of the Naval War College in partial satisfaction of the requirements of the Department of Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College nor the Department of the Navy.

Signature:

Approved by
Faculty Advisor:

Signature:

Robert Booker, CDR, USN

This document has been approved
for public release and sale; its
distribution is unlimited

16 May 1994

Paper directed by
Captain D. Watson
Chairman, Department of Operations

94-25908



3506
94 8 16 040

UNCLASSIFIED

Security Classification This Page

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED			
2. Security Classification Authority:			
3. Declassification/Downgrading Schedule:			
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.			
5. Name of Performing Organization: Joint Military Operations Department			
6. Office Symbol: 1C		7. Address: Naval War College, 686 Cushing Rd., Newport, RI 02841-5010	
8. Title (Include Security Classification): METEOROLOGICAL FACTORS AT THE OPERATIONAL LEVEL OF WAR (UNCLAS)			
9. Personal Authors: Jeffrey L. Barker, CDR, USN			
10. Type of Report: Final		11. Date of Report: 1994 May 16	
12. Page Count: 31			
13. Supplementary Notation: A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Joint Military Operations Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.			
14. Ten key words that relate to your paper: METEOROLOGY, WEATHER, OVERLORD, PRINCIPLES OF WAR, CLIMATOLOGY, STRATEGY, TACTICS, VIETNAM, CLIMATE, ENVIRONMENT.			
15. Abstract: This paper examines some historical cases where weather has been a factor in the outcome of military operations. In World War II, Vietnam, and Desert Storm, climatology is shown to have been extremely important. In an examination of World War II, the paper provides an example of how a commander's use of operational weather can give his fighting forces an enhanced capability. In a discussion of Vietnam, the paper exposes how military performance in the wake of adverse weather conditions can provide an indication of the operational ability to meet the strategic goals. Finally, applying meteorological factors to the principles of war shows that weather does not have a neutral effect in warfare; under every circumstance one side or the other benefits from the state of the environment.			
16. Distribution / Availability of Abstract:	Unclassified	Same As Rpt	DTIC Users
18. Abstract Security Classification: UNCLASSIFIED			
19. Name of Responsible Individual: Chairman, Joint Military Operations Department			
20. Telephone: (401) 841-3414/4120		21. Office Symbol: 1C	

Security Classification of This Page UNCLASSIFIED

METEOROLOGICAL FACTORS AT THE OPERATIONAL LEVEL OF WAR

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PAGE</u>
ABSTRACT	ii
I. HISTORICAL EXAMPLES PRIOR TO WORLD WAR II	1
II. WORLD WAR II	5
THE WEATHER WAR IN EUROPE: FROM GREENLAND TO OVERLORD	5
THE WEATHER WAR IN THE PACIFIC: FROM PEARL HARBOR TO SIBERIA	10
III. VIETNAM WEATHER: ADVANTAGE TO THE INSURGENCY	13
IV. DESERT STORM	16
V. APPLICATIONS TO THE PRINCIPLES OF WAR	18
VI. CONCLUSIONS	21
VII. PERSPECTIVE	24
APPENDIX A	25
ENDNOTES	27
BIBLIOGRAPHY	30

Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

ABSTRACT

This paper examines some historical cases where weather has been a factor in the outcome of military operations. In World War II, Vietnam, and Desert Storm, climatology is shown to have been extremely important. In an examination of World War II, the paper provides an example of how a commander's use of operational weather can give his fighting forces an enhanced capability. In a discussion of Vietnam, the paper exposes how military performance in the wake of adverse weather conditions can provide an indication of the operational ability to meet the strategic goals. Finally, applying meteorological factors to the principles of war shows that weather does not have a neutral effect in warfare; under every circumstance one side or the other benefits from the state of the environment.

I. HISTORICAL EXAMPLES PRIOR TO WORLD WAR II

The influence of climate and weather in all human endeavors is intuitive to most people. Through the centuries people have learned when to plant, harvest, and celebrate based on seasonal changes. Historically, weather has also been an instinctive consideration in warfare. In *History of the Peloponnesian War*, Thucydides speaks of the Spartans going to war in the spring of 431 B.C., as if spring was the natural time for wars to begin.¹ Spartan operations in the winter of 429 B.C. against the Athenian port of Piraeus caught the Athenians by complete surprise because they believed that it was not possible to go to war in the winter.² Genghis Khan also employed weather conditions to enhance the principles of war. A favorite operational tactic used to simplify his mobility problem was to maneuver in the winter. In his area of operation, rivers and marshes would freeze, allowing his Mongol horsemen to merely gallop over the ice and conduct their business without impediment.³ His ability to maneuver was greatly enhanced by his employment of primitive climatology.

Beyond offering enhancements to the ability to fight, weather has also been used to explain the outcome of wars. For example, a fierce series of storms is often credited with the destruction of the Spanish Armada. Though the storms did take a minor toll, they were not the deciding factor in the ruin of the Armada. The Armada was defeated by faster ships, better guns, and more cunning captains. However, for political and religious reasons, the English and Spanish historical accounts of the encounter are skewed

toward acknowledging the storms' destruction of the Armada. The Spanish were more than happy to blame their tactical and operational failures on the weather, and the British were equally pleased to accept that notion. The English belief was that tall-tales of the Spanish defeat by a God-sent storm was proof that Protestantism was superior to Catholicism. In the end, the Spanish found it easier to accept a defeat at the hands of God rather than at the hands of English pirates.⁴

The cold-weather misfortunes of Napoleon during his Russian campaign are a part of every lecture, paper, or discussion that contains his name. However, those analyses often fail to emphasize that Napoleon was repeatedly warned of the severity of Russian winters by General Caulaincourt who had spent several seasons in Russia. As winter approached, the other French generals in Moscow joked with Napoleon about the doom and gloom of Caulaincourt's weather predictions; Caulaincourt was indeed still serious. He reminded Napoleon in October:

The winter, sire, is a big difficulty, to begin with. The lack of stores, of horses for your artillery, of transport for your sick and wounded, the poor clothing for your soldiers. Every man must have a sheepskin, stout fur-lined gloves, a cap with ear-flaps, warm boot-socks, heavy boots to keep his feet from getting frost-bitten. You lack all this. Not a single frost-nail has been forged for the horses' shoes; how are you going to draw the guns? There is no end to what I could tell Your Majesty on this subject. Then there are your communications, the weather is still fine, but what will it be in a month, in a fortnight, perhaps even less?⁵

Napoleon arrogantly replied:

The extreme rigors of winter do not come on in twenty-four hours. Although we are less acclimatized than the Russians, we are fundamentally more robust. We

have not had autumn yet, we shall have plenty of fine days before winter sets in.⁶

As it had done for centuries, the Russian winter became a factor that favored the home team. However, weather was not solely responsible for the French defeat. The Russians took advantage of the weather by waiting out Napoleon, letting his supplies dwindle, and then attriting his forces by using maneuver and economy of force.

The British have a miserable weather-related story to tell of their expedition to the Crimea in the 1850's. As the British and their allies prepared for the onset of winter on the Crimean Peninsula, a severe storm caused a fleet of supply ships to run aground in the Black Sea. Without the supplies, the British were without enough hay for their horses and food for their men. The combination of winter and lack of supplies resulted in as many casualties as did the actual fighting.⁷ The entire experience in the Crimea was so dreadful that an investigation was undertaken to see if the storm could have been predicted. A French scientist gathered all the weather data of the period in question and concluded that a method could be developed to distribute weather warnings that would prevent a similar occurrence in the future.⁸

By World War I, several nations had begun to use meteorologic information and associated communication networks in military operations. The introduction of the airplane to warfare was predominately responsible for the increased significance in wartime meteorology, but also important was the widespread use of chemical weapons. Additionally, WWI saw the first use of the upper-air

winds as corrections to artillery fire-control solutions that enhanced the accuracy of long-range guns.' For the most part, the technological breakthroughs in meteorology were limited to the tactical level of war, and the use of climatology in planning military operations was found mainly at the strategic level of war.

II. WORLD WAR II

By the time World War II began, there were plenty of examples of the serious effects of weather on the way wars were fought. As far as the typical military leader was interested, there were tactical weather considerations, and there were strategic weather considerations. On the tactical side, the question was, "What is the weather like now, and how will it affect the fight?" On a strategic level, the question asked by the commander was based more on climate; "What is the best season in which to fight and defeat the enemy?" or "What is the season not to undertake an offensive?" As the operational level of war developed, weather considerations from the tactical and strategic levels began to be used simultaneously.

THE WEATHER WAR IN EUROPE: FROM GREENLAND TO OVERLORD

From the point of view of a meteorologist, weather forecasting in Europe during World War II had its roots in Norway. During World War I, Norway found itself cut off from weather information from the warring participants. Meteorological data that had previously been available through international cooperative agreements were no longer being distributed.¹⁰ Because of the importance of weather to Norway and other Scandinavian countries, the Scandinavians expanded their data gathering network into Greenland and other arctic territories controlled by Scandinavian governments.

The quest for meteorological data by the Germans in support of future operations in Europe began well before WWII started.¹¹

Early German meteorologic operations were conducted by the dirigible *Graf Zeppelin* in the 1930's. The *Graf Zeppelin* made several transatlantic and arctic crossings during which her crew gathered climatic data including temperature, prevailing winds, humidity, pressure, and static electricity.¹² The potential meteorologic database grew after Hitler invaded and captured Denmark and Norway,¹³ allowing Germany to claim the North Atlantic meteorological reporting stations the Norwegians and Danes previously controlled, including Greenland.¹⁴

The Germans were also keenly aware of the importance of Greenland in attaining an operational edge in the war in Europe. A lesser-known battleground during World War II, Greenland was important for its location; not only was it on the flight route between North America and Europe, but it also provided valuable meteorological observations to forecasters in Europe. The Allies were aware of the German desire to exploit the Greenland area and sent armed patrols and U.S. Coast Guard ships to try to neutralize the Germans.¹⁵

The first evidence of Germans using their climatological knowledge to gain an operational advantage was the time picked for the start of their campaign into Poland. The dry season in Poland normally begins in September; 1939 was no different, and the Germans used this advantage to quickly take Poland.¹⁶ Following that success, the German High Command followed the advice of their meteorologists as to the best time to invade France, which turned out to be May 1940.¹⁷ May was chosen because it offered the best

flying and terrain conditions for a blitzkrieg campaign that would achieve the strategic goal of taking France. Based on that success, Hitler relied heavily on the advice of his meteorologists at the outset of *Operation Barbarossa*.¹⁸ Again following their climatic prognostications in 1941, Hitler had initially planned to have the campaign on Moscow completed before the onset of winter¹⁹, but along the way he changed his focus and lost sight of the ultimate objective.²⁰ The result was much the same as other historical winter expeditions into Russian territory.²¹

In spite of the military failure in Russia, the Germans kept faith in their meteorologists and continued to rely on their advice. One example of how the Germans used their weather data and forecasts to allow their forces to attack in mass occurred near Schweinfurt on October 14, 1943. The Americans were well known for their daylight bombing raids, and on this day German meteorologists forecasted that the area around Schweinfurt would be the only area within reach of the bombers that would have the conditions needed for a U.S. bombing mission. Armed with that meteorological information, the German operational commander decided to gather his fighters around Schweinfurt. What he accomplished by massing his forces was to shoot down the highest percentage of U.S. aircraft to that date.²²

In the constant quest for weather data that was upstream from Europe, the pitch of operations in Greenland in early 1944 had increased.²³ The Allies, certain that they would be conducting an operation to invade France soon, wanted to make sure that they

would be able to take full advantage of the weather prior to the invasion; at the same time the Allies wanted to deny the Germans any advantage they might gain by having meteorological data. The Germans were at such a disadvantage that they used some of their valuable U-boats for nothing other than to gather data in the North Atlantic.²⁴

In November 1943, Colonel J. M. Stagg, the man who was the staff meteorologist for the Chief of Staff to the Supreme Allied Commander (COSSAC)¹ was told very generally what the desired meteorological conditions were to conduct a landing in France. COSSAC told Colonel Stagg that the Allies wanted a period of "quiet weather" that would coincide with low tide (to expose obstacles).²⁵ These conditions were difficult to specifically define because, as a joint operation, each part of the staff had a different idea what "quiet weather" meant. The air forces made the problem more difficult by having different parameters for bombers, fighters, gliders, and paratroops.²⁶ Eventually, the staff agreed on what they wanted, and Colonel Stagg knew that he would not have very many windows of opportunity to present to General Eisenhower.

Based on the input from the staff at COSSAC, the allied meteorologists studied the climatic statistics and found that May and June were much preferable over July. June was preferred over May, but only marginally. The advantage that May offered was that if weather would preclude the operation, then June would be

¹ COSSAC became Supreme Headquarters Allied Expeditionary Force (SHAEP) in January 1944.

statistically satisfactory to conduct the landing. However, if June was the first choice and bad weather precluded the operation, conditions necessary for a successful operation in July were statistically bleak.

General Eisenhower decided against a May landing for strictly military readiness reasons and made June his first choice.²⁷ The best date as far as the moon and tides were concerned was June 5, 1944. General Eisenhower postponed the June 5 landing at the last possible moment as the forecast indicated a severe storm moving through the English Channel. Ironically, the winds over England and France were howling as the allied forecasters were calling for a period of "quiet weather" for June 6, 1944.²⁸

The correct forecast made by the Allies relied heavily upon the meteorological data from stations in Greenland, Iceland, and many ships at sea in the North Atlantic. Without the same critical data, it was impossible for the Germans to make any kind of a forecast that would have predicted the huge break that the Allies saw; consequently, on June 4/5 the German meteorologists advised their generals that they saw only continuously disturbed weather for the following week and beyond. Based on that erroneous information, Germany deemed that an invasion was not imminent.²⁹

The Germans had expected the invasion to occur during several quiet periods of weather that had occurred in May. They had also anticipated May as the time-frame for the Allied landing because four years earlier they had chosen May as the best time for them to invade France. As it turned out, there were very few days that

year that would have been better than June 6, 1944 for the Allies to have landed in France.³⁰

Overlord was a bold operation that made the most of meteorological skills and data that the Allies had available. The successful application of climatology and real-time meteorology was no accident; it had been part of the planning and coordination that had gone on for years.

THE WEATHER WAR IN THE PACIFIC: FROM PEARL HARBOR TO SIBERIA

The Japanese used weather successfully to hide their intentions and their positions prior to the attack on Pearl Harbor.³¹ Operationally, the Japanese attack was better than anything they could have hoped for. To say the weather cooperated for the Japanese is to overlook the extent to which they planned to use the fog and clouds of the North Pacific. The environment gave the Japanese added security, the ability to focus their forces on the attack, and the advantage of total surprise. However, in spite of the Japanese ability to use the weather to their advantage at the tactical and operational levels of war, they nevertheless were unable to win the war at the strategic level that had nothing at all to do with the weather. The advantage gained by exploiting meteorologic knowledge was not enough to overcome the overall military might of the United States.

In the Pacific Theater, the Japanese initially had the upper hand in the ability to obtain meteorologic data. Japan had total control of the meteorological data that was originated in China, Manchuria, Korea, and Japan.³² Until an agreement was made with

the Soviets for them to share their meteorological data resources, the Americans had almost no weather information in the northwest Pacific.³³ With all of Siberia under their control, the Soviets had set up a remarkable weather observation network. These weather reports were very valuable for identifying the jetstream that normally followed a course out of Siberia and Manchuria and flowed over Japan. This information gave the Army Air Corps a starting point when planning B-29 operations over mainland Japan late in the war. The clandestine agreement with the Soviets was a tremendous benefit for the United States in the air war in the Pacific.

At sea, the Americans had some extreme problems that were credited to the weather. Most notably were the two typhoons that Admiral Halsey's fleet faced in less than a year.³⁴ In the first encounter, three of his ships were lost due to a series of errors that Halsey never admitted were his fault.³⁵ Simply put, Admiral Halsey was so focused on refueling his ships that he unduly risked the safety of the entire fleet. By trying to press on with the refueling of his ships in the face of miserable seas, Admiral Halsey allowed the Japanese to acquire an advantage that was totally unexpected. Had he understood the principle of security as well as he understood the principles of the offensive, maneuver, and economy of force, he would not have lost three ships and had several others put out of action due to storm damage. In spite of the severe run-ins with the weather, the joint focus of McArthur, Nimitz, and LeMay, combined with all the firepower at their

disposal, allowed the Americans to manage a strategic victory in the Pacific.

III. VIETNAM WEATHER: ADVANTAGE TO THE INSURGENCY

Tropical weather is dynamically different from weather in the middle latitudes; therefore, the need for far-away weather was not as critical as in the European theater previously discussed. The most important weather data for military applications in Vietnam were nearby observations and climatology. New on the meteorological scene during the Vietnam War was the production of satellite weather images. This technological breakthrough allowed commanders to see right away where operations would be most affected by weather, and they could react accordingly.³⁶ In spite of the technical superiority of the United States in Vietnam, it was the Communists who most often took the advantage. The Communists were familiar with the weather patterns and planned all their offensive operations accordingly. The North Vietnamese regularly frustrated the more technically advanced Americans by maneuvering under cloud cover during times that were, from a climatic outlook, predictable. In essence, there was quite a bit of time that the advanced weaponry of the U.S. was neutralized by the tropical weather.³⁷

Weather has often been used to explain tactical, operational, and strategic failures. As Vietnam has come to be known as America's foremost military failure, it is no surprise to find a number of examples where the military leadership used the bad weather as an excuse for the inability to force the enemy to follow the script. In reality, the weather cycle in Indo-China was well documented by years of climatology that were completely available

to all the operational commanders in the theater and in the Pentagon. There should have been no surprise to any American commander that the weather in Southeast Asia would present some extraordinary challenges. However, note the implication of the congressional testimony of the Chairman of the Joint Chiefs of Staff, Admiral Thomas Moorer, as he tried to explain the below-expected performance of the bombing missions during *Linebacker II* in December 1972:

I could say just a little about the weather, because the weather is quite seasonal in North Vietnam and in the whole Southeast Asia area. We were then in the middle of ... the northeast monsoon period. This meant, then, that there would be very few days in North Vietnam during the Christmas period when it would be possible to make visual attacks. Therefore, it was necessary to use those resources; namely, the B-52's, the F-111's, and A-6's, that had an all-weather capability. As a matter of fact, as it turned out, during the period that we were conducting the operations, which lasted from December 18 to 29, with the exception of a 36-hour standdown for Christmas, there were only about 12 hours which were suitable for visual bombing, including use of the so-called "smart" bombs.³⁸

The best operational use of exploiting climatology in Southeast Asia by the United States was the offensive thrust from Vietnam into Cambodia in May 1970. The invasion was effectively timed to fall at the end of the dry season to afford the American forces good conditions in which to carry on the surprise operation. Additionally, any resultant Communist efforts to replenish or reinforce their forces after the American attack would be hindered by torrential rains brought on by the reliable southwest monsoon. The meteorologic forecast that was factored into the operational planning for the Cambodian operation was only a small piece of the

total effort.³⁹ What really made the operation successful was the combination of using sound meteorologic principles along with maneuver, massing of forces, surprise, and the other classic principles of war.

Thus, in Vietnam the U. S. showed that using the weather as an integral part of the operational planning and execution only yields positive results if there are operations that are working toward an overall strategy of victory. Since the United States' strategy was not geared toward winning in Vietnam, then there really was never an opportunity to consistently exploit the weather to that end.

The recurring complaints of the weather's negative effects on operations in Vietnam (of which there were many)⁴⁰ sound much like those of the Spanish after the Armada was defeated. It is much easier to admit to the proposition that one's demise was caused by something uncontrollable like the weather, rather than to admit to being beaten by an enemy that at the outset of the campaign was considered to be inferior.

IV. DESERT STORM: ADVANTAGE TO THE COALITION

The desert offered the United States and the Coalition forces another kind of meteorologic challenge. Weather was considered to be such a major factor that the ground war was timed to take advantage of climatic conditions in the desert.⁴¹ While the Coalition forces could have fought in any season, a war in the summer heat of the desert would have added considerably to the degree of difficulty.

Military meteorologists were heavily involved at all levels in many aspects of the planning and the successes of Desert Storm. The Coalition forces had a wide range of sources of meteorological data from encrypted satellites, from world-wide networks, and also from classified sources. At the same time, the Coalition saw to it that the Iraqis were denied access to meteorologic data as part of the sanctions imposed by the United Nations after the Iraqi invasion of Kuwait. Before any fighting began, the Coalition force's meteorologic data base was superior, allowing them to maintain an advantage throughout the war, much like the WWII Allies did once they had effectively denied weather data to the Germans.

With the meteorologic advantage at the strategic and operational level, the war in the desert was a tactical testing ground for the meteorologic support to new weapons systems. Weather data was used as part of the Tomahawk cruise missile initial data input; to determine how reconnaissance aircraft were to be configured; in selecting the optimum precision guided

munitions; and to give an indication of the expected performance of night-vision equipment and infrared targeting systems.⁴²

At times the leadership was frustrated by the effects of weather, but there was never any of the Vietnam-style blame-it-on-the-weather whining. Climatology was on the side of the operational commander, and the offensive course of action that had been chosen and approved all the way to the White House was deeply rooted in applying the principles of war. In the desert, the weather affected every individual, but through integration of strategic meteorological factors in the planning and action phases of the war, the Coalition's exploitation of the environment was an unqualified success.

V. APPLICATIONS TO THE PRINCIPLES OF WAR

Nowhere in the accepted list of fundamental principles of war is there a category called "The Principle of Weather Exploitation."⁴³ However, each principle of war can be enhanced by meteorological knowledge (See Appendix A). That knowledge can be used at the strategic, operational, or tactical level of war.

The most effective way to enhance an overall strategy, would be to apply climatology to strengthen strategic performance. After successfully applying climatology to warfare in France and Poland, Germany's messy exhibition in Russia is mystifying from a meteorologic standpoint. Perhaps if Hitler's meteorologists had run into a proverb-wise Russian farmer, they might have overheard the old Russian saying: "It takes only a spoonful of water to make a bucket of mud."⁴⁴ Then they could have reemphasized to the German High Command that in the rainy season, the combination of light, steady drizzle and Russian soil would considerably slow the tardy German advance to Moscow. If following the advice of an old Russian farmer was not of German character, then they could have heeded the 1864 dictum of the elder von Moltke who insisted, "An operation must be based not on the weather but on the season."⁴⁵

At the operational level of war, meteorological considerations contain both tactical and strategic considerations. In the execution of *Overlord*, the Allies needed a wealth of statistical information to infer which was the correct season to begin their strategic offensive while at the same time integrating factors that would affect the tactical considerations of both the men in the

small boats at the mercy of the waves and the paratroops at the mercy of the winds. Successful operations since *Overlord* have followed the same pattern.

Tactical applications of the weather have occurred throughout history. The ancient archer firing a flaming arrow quickly learned to compensate for the wind. Today, the archer's arrow can be a long-range cruise missile or other sophisticated weapon that needs more meteorologic data than just a correction thrown in by an experienced marksman.

To succeed in warfare, tactical weather inputs have to be integrated into the overall strategic purpose, or the tactical advantage is negated. In Vietnam, the Air Force Weather Service and Naval Weather Service were superb as they routinely advised the warfighter on weather at target sights, the limitations of weapons systems, and even what kind of weather to expect in a few weeks. However, the services provided by the meteorologists in Southeast Asia became so routine and habitual that providing those services was the only goal. There was no fusion of the weather information into a coordinated effort to set conditions that would provide for a strategic victory in Vietnam. With the exception of the minor operation from Vietnam into Cambodia, the United States mainly applied her meteorological resources at the tactical level of war, which the United States won; however, the real victory was decided at a different level.

Finally, significant in military applications of meteorology is the climatic and real-time data itself. However, the importance

of meteorologic data is borne out by the extent to which countries will go to obtain and deny to each other that information. Germany and the Allies were posturing to ensure the future availability of weather data long before their populations knew that war was going to break out. The availability of weather information is often taken for granted by the operational commander; the key to future success is the proper application of available resources to the principles of war.

VI. CONCLUSIONS

The time for operational commanders to worry about how the weather will affect their campaigns is in the initial planning stages. A preponderance of evidence shows how desperately the German Air Force and Navy were trying to get meteorological information from areas so far away from the front. Additionally, the success of the Allies in *Overlord* was more than just good luck and intuition; it was the result of planned, coordinated operations that focused heavily on how the logical principles of war could be enhanced by the effects of the weather. Whether or not the Allies had favorable weather or not on D-Day would not likely have changed the eventual outcome of World War II. But the forecast made by Colonel Staggs and the resulting decision to go gave the Allies a very high security factor. The work done by all the meteorologists and the fighting men who enabled the data to get to England greatly enhanced the fighting power of the men who hit the beach. The advances in communications meant that weather observations could be transmitted almost instantaneously throughout the world. This, combined with progress in understanding the dynamics of weather gave General Eisenhower a unique opportunity in which to conduct *Overlord*. Hence, the culminating point of war in Europe occurred at the same time as the defining moment for operational meteorology.

Since World War II much has been made of the technological advances that have allowed the armed forces to gather and disseminate weather data at all levels of warfare. The technology

only makes the job of getting the meteorological information into the hands of the commander easier. However, if the commander does not choose to employ the information in an intelligent manner, then the information has no real value; the United States showed this in their overall strategy in Vietnam. A foe without the same level of technology can gain an advantage by applying age-old weather tactics.

Commanders can derive a simple lesson, which is largely undocumented, from their own or their subordinates' after-action reports. That is, if weather has been reported as seriously affecting a force's ability to fight to the extent that the environment is being blamed for failure after failure, then the commander has to question whether those forces have been overextended, have ineffectual leadership, or are being used in a way that is not geared toward plausible victory. The historical examples of this phenomena are well documented by the Spanish Armada, Napoleon's march to Moscow, the British in the Crimea, the Germans in Russia and the North Atlantic, and even America in Vietnam. Weather often affects tactics, but it cannot be used as a scapegoat for the lack of a cogent strategy nor for the lack of a feasible operational plan.

Climate and weather are always going to be factors in every military undertaking; intuitively every commander knows that. Knowledge of climate and near-term weather will enhance a military force's ability to plan and adjust how it conducts itself in battle. A commander who attributes a series of military failures to

bad weather is comparable to the pilot who, after running out of fuel, blames gravity for the crash. Before every operation the commander has to ask, "Am I going to be a whiner, or a winner?" and make plans accordingly because in war, weather is never neutral.

VII. PERSPECTIVE

If an operational commander were to take the nine principles of war and then list the factors that would affect each one of those principles, weather would definitely be a factor on each list. However, if the operational commander was then asked to prioritize his list of factors under each principle of war, weather would never be the first consideration. Therefore, the possibility that weather alone could be regarded as the factor which turned the tide at the operational level of war is inconceivable. This is often difficult for many military meteorologists to accept. But the reality of the situation is highlighted by General Eisenhower who, after meeting with his staff meteorologist twice a day for months leading up to the single most important operation in history, gives him only two pages in his book.⁴⁶

APPENDIX A

Weather as a factor to each Principle of War

Objective: Overlord: The entire U.S. campaign to use Greenland as a source for weather data and deny the data to the Germans.

Offensive: America on D-day, America in Cambodia, Japan at Pearl Harbor, America in Desert Storm, Germany into France and Poland.

Mass: The Germans concentrating their fighters to the only area where a daylight bombing raid could be conducted and then handing the Army Air Corps its worst defeat to that point.

Economy of Force: The American plan into Cambodia bet on the weather slowing or preventing Communist resupply and reinforcement, thus allowing the Americans to bring only the forces they would need to fight the enemy that was there.

Maneuver: Weather knowledge assisted the U.S. in getting into Cambodia and operating effectively. Overlord. Pearl Harbor: the Japanese used the fog they knew so well in the North Pacific to hide their fleet and get into a position to attack. Germany invading Poland and France.

Unity of Command: Overlord: though there were several entities that had the ability to forecast the weather, all of those groups were aligned so that General Eisenhower would get only one meteorological input. Conflicting data from different sources would have been counter-productive or confusing.

Security: The goal of every operation is to never let the enemy gain any advantage. By waiting a day to land at Normandy, General Eisenhower increased the degree of success and also saved many lives by not putting his men into further added danger that bad weather would have created. The British in Crimea, Napoleon, and Hitler learned the same lesson of the risks involved in operations into Russia during winter.

Surprise: The Spartans at Piraeus. The Japanese at Pearl Harbor. The Allies during Overlord. The Germans at Schweinfurt. The Americans into Cambodia from Vietnam.

Simplicity: Desert Storm: The Americans attacking in the desert during the winter when it is not 138 degrees in the shade. Genghis Khan riding over frozen marshes and rivers to conduct operations.

ENDNOTES

1. Thucydides, *History of the Peloponnesian War*, Penguin Books, (London: 1954), p. 124.
2. Thucydides, p. 185.
3. John F. Fuller, "Weather and War," United States Air Force Military Airlift Command, Scott Air Force Base, 1974, p. 1.
4. Garrett Mattingly, *The Armada*, Houghton Mifflin Company, (Boston: 1959), pp. 390-391.
5. Leonard Cooper, *Many Roads to Moscow*, Coward-McCann, Inc., (New York: 1968), p. 138.
6. Leonard Cooper, p. 138.
7. Peter Gibbs, *Crimean Blunder*, Holt, Rinehart and Winston, Inc., (New York: 1960), pp. 255-257.
8. Gary D. Atkinson, "Impact of Weather on Military Operations: Past, Present, Future," U.S. Army War College, 1973, p.6.
9. Atkinson, p.6.
10. Wesley F. Craven and James L. Cate, *The Army Air Forces In World War II*, U.S. Government Printing Office, (Washington: 1983), Vol VII, p. 311.
11. George Simmons, *Target: Arctic*, Chilton Books, (Philadelphia: 1965), p. 230.
12. C. V. Clines, *Polar Aviation*, Franklin Watts, Inc., (New York: 1964), pp. 77-87.
13. David Howarth, *The Sledge Patrol*, The MacMillian Company, (New York: 1957), pp. 8-13.
14. Malcolm F. Willoughby, *The U.S. Coast Guard in World War II*, United States Naval Institute, (Annapolis: 1957), p. 95.
15. Willoughby, pp. 95-110.
16. E. A. Pearce and C. G. Smith, *World Weather Guide*, Times Books, (New York: 1984), pp. 401-403.
17. Atkinson, p. 11.
18. Atkinson, p. 11.

19. Matthew Cooper, *The German Army 1933-1945*, Scarborough House, (Lanham: 1978), p. 259.
20. Matthew Cooper, p. 299.
21. Matthew Cooper, pp. 337-338.
22. Craven and Cate, p. 312.
23. Willoughby, p. 108.
24. Willoughby, pp. 95-110.
25. J. M. Stagg, *Forecast for Overlord*, W. W. Norton & Company, Inc., (New York: 1971), p. 13.
26. Stagg, pp. 11-16.
27. Dwight D. Eisenhower, *Crusade in Europe*, Doubleday and Company, (New York: 1948), pp. 238-239.
28. Stagg, p. 115.
29. Stagg, pp. 127-128.
30. Stagg, p. 126.
31. Craven and Cate, p. 312.
32. Charles C. Bates and John F. Fuller, *America's Weather Warriors 1814-1985*, Texas A&M University Press, (College Station: 1986), p. 106.
33. Bates and Fuller, pp. 128-130.
34. Hans Christian Adamson and George Francis Kosco, *Halsey's Typhoons*, Crown Publishers, Inc., (New York: 1967), p. xi.
35. C. Raymond Calhoun, *Typhoon: The Other Enemy*, Naval Institute Press, (Annapolis: 1981), p. 208.
36. Fuller, p. 16.
37. Atkinson, p. 30.
38. U.S., Congress, House, Subcommittees on Department of Defense and Military Construction of the Committee on Appropriation, Hearings, Department of Defense Appropriations, 93d Cong, 1st Sess, 1973, p. 5.
39. Atkinson, pp. 25-26.

40. Fuller, pp. 11-16.
41. Barbara L. Brehm, "Weather: Operational Considerations on the Battlefield," Naval War College, 1991, p. 12.
42. "Conduct of the Persian Gulf: An Interim Report to Congress," July 1991, p. 15-2.
43. Department of the Army, *Field Manual 100-5*, (Washington: 1993), pp. 2.4-2.6.
44. Russell H. S. Stolfi, Lecture, Naval Postgraduate School, ca. Nov. 1987.
45. Leonard Cooper, p. 215.
46. Eisenhower, pp. 249-250.

BIBLIOGRAPHY

- Adamson, Hans Christian and George Francis Kosco. *Halsey's Typhoons*. New York: Crown Publishers, Inc., 1967.
- Atkinson, Gary D. *Impact of Weather on Military Operations: Past, Present, Future*. U.S. Army War College, 1973.
- Bates, Charles C. and John F. Fuller. *America's Weather Warriors 1814-1985*. College Station: Texas A&M University Press, 1986.
- Brehm, Barbara L. "Weather: Operational Considerations on the Battlefield." United States Naval War College, 1991.
- Calhoun, C. Raymond. *Typhoon: The Other Enemy*. Annapolis: Naval Institute Press, 1981.
- Clines, C. V. *Polar Aviation*. New York: Franklin Watts, Inc., 1964.
- Cooper, Leonard. *Many Roads to Moscow*. New York: Coward-McCann, Inc., 1968.
- Cooper, Matthew. *The German Army 1933-1945*. Lanham, MD: Scarborough House, 1978.
- Craven, Wesley F. and James L. Cate. *The Army Air Forces In World War II*. Volume VII. Washington: U.S. Government Printing Office, 1983.
- Eisenhower, Dwight D. *Crusade in Europe*. New York: Doubleday and Company, 1948.
- Fuller, John F. "Weather and War. Scott Air Force Base: United States Air Force Military Airlift Command, 1974.
- Gibbs, Peter. *Crimean Blunder*. New York: Holt, Rinehart and Winston, Inc., 1960.
- Howarth, David. *The Sledge Patrol*. New York: The MacMillian Company, 1957.
- Mattingly, Garrett. *The Armada*. Boston: Houghton Mifflin Company, 1959.
- Pearce, E. A. and C. G. Smith. *World Weather Guide*. New York: Times Books, 1984.
- Simmons, George. *Target: Arctic*. Philadelphia: Chilton Books, 1965.

Stagg, J. M. *Forecast for Overlord*. New York: W. W. Norton & Company, Inc. 1971.

Thucydides. *History of the Peloponnesian War*. London: Penguin Books, 1954.

United States Congress, House, Subcommittees on Department of Defense and Military Construction of the Committee on Appropriation, Hearings, Department of Defense Appropriations, 93rd Congress, 1st Session, 1973.

United States Department of the Army. *Field Manual 100-5*, Washington, D. C., 1993.

Willoughby, Malcolm F. *The U.S. Coast Guard in World War II*. Annapolis: United States Naval Institute, 1957.